Observations on the Breeding of Major Carps in Madhya Pradesh[1]

BY

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(*With two plates and four text figures*)

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1. Introduction

The efforts now being progressively made in India by the State and Central Governments to increase inland fish production by culturing major carps such as *Labeo rohita*, *Catla catla*, and *Cirrhina mrigala* in impounded waters have resulted in an increased demand for the fry of these fishes for stocking purposes. The fry is largely collected in East Bengal, either from rivers or from tanks of the bund type. Since major carps do not normally breed in captivity, considerable difficulty is being experienced in augmenting the supply to meet this growing demand. Hora (1945), in concluding the symposium on 'Factors influencing the spawning of Indian Carps', stated that the flood condition of a river or a tank is the primary factor responsible for the spawning of major carps, and that a high pH value and oxygen content of water are a necessary corollary to floods, but have no independent value in inducing spawning. Saha *et al* (1957), while investigating the spawning conditions of two wet type[2] and two dry-type bunds in Midnapore, concluded that the flood water helped to lower the pH to favourable limits. Hamid Khan (1945) pointed out the role of pituitary hormones in breeding behaviour, but did not succeed by its use in inducing major carps to spawn.

[1] Communicated by Dr. C. V. Kulkarni, Director of Fisheries, Maharashtra.

[2] Holding water throughout the year, as opposed to dry-type, which are seasonal and remain dry for a portion of the year.

Chaudhuri & Alikunhi (1957), however, achieved considerable success in breeding the fish artificially by pituitary injections prepared from major carps themselves. This achievement has great potentiality in the future for raising fry-production, but efforts to collect fry from natural sources of water continue in each State so as to meet the local requirements.

In the former Madhya Bharat Zone of Madhya Pradesh, attempts have been made since 1949 to procure as much fry as possible by discovering new spawning grounds. During the year 1958, as many as 25 lakhs of fry and fingerlings were collected but even this quantity was insufficient for the 1.25 lakh acres of water which was to be stocked. If stocking is done at the rate of 1500 fry per acre, the annual requirement would be about 187.15 million of fry and fingerlings.

2. Fish Seed Resources and Breeding Grounds

Extensive survey has been undertaken in Madhya Pradesh to discover breeding grounds. A large number were located which are classified and described in the following four categories :

(*a*) River as a Home and Spawning in Inundated Fields

Breeding grounds have been located in inundated fields at Baghthera, Sonarpura, Khared, Sankalkheda, and Imalia-Jamalbagdi villages :

(i) Baghthera. (B, Sketch-map No. 1). Brooders of *Labeo calbasu*, *Labeo gonius*, and *Cirrhina mrigala*, coming from the River Vaisli along a nullah about 8 miles long, 6 ft. deep, and 10 ft. wide, have been observed to spawn in about five acres of inundated agricultural fields. The chemical conditions of the water at this spawning area are given in Table I.

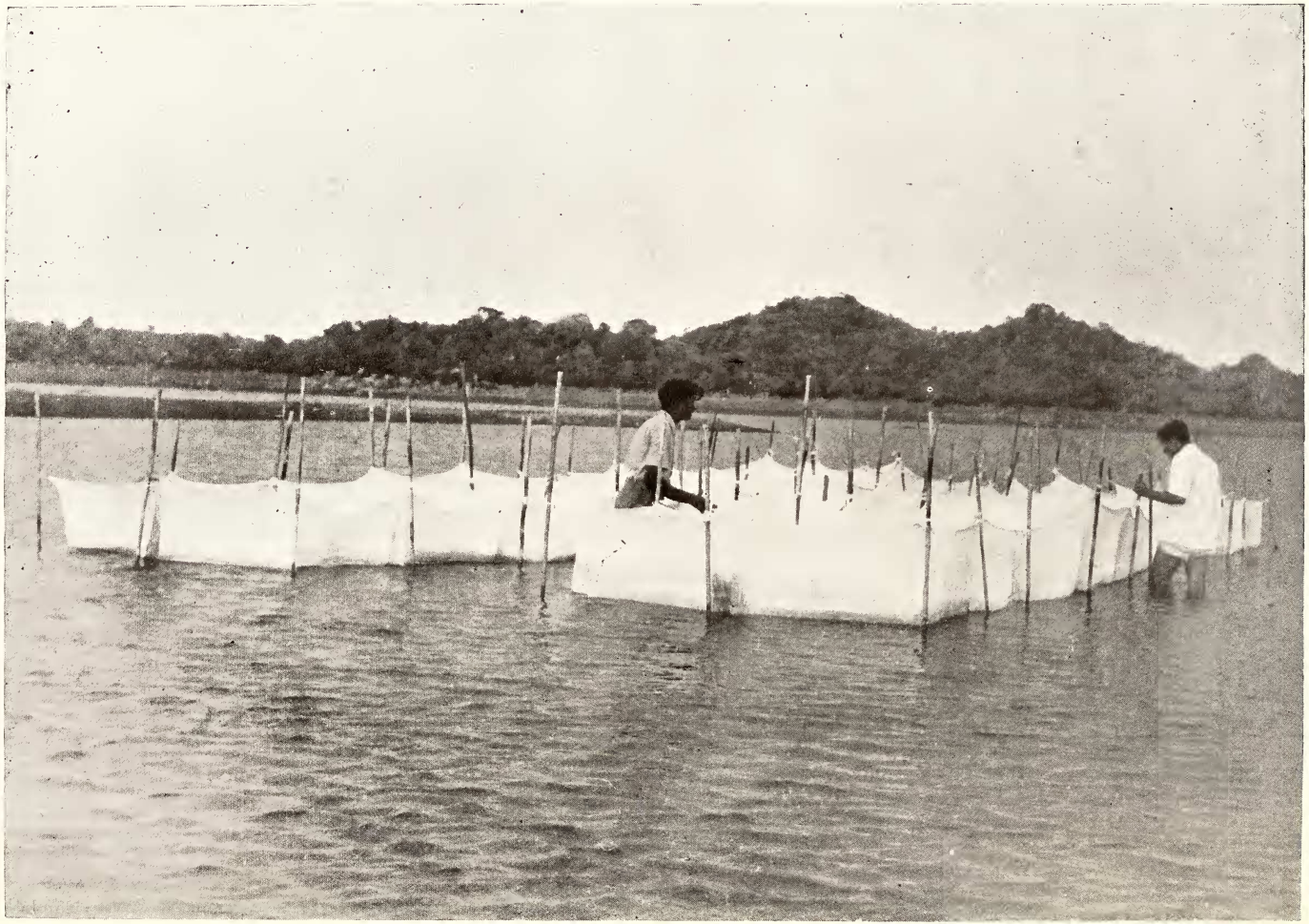
Table I

	Date	pH	Temp.	O_2	CO_2
Baghthera	8-7-58	7.6	30.00	6	2.1
Banmore	8-7-58	7.8	32.30	—	—
	9-7-58	8.2	33.30	—	—
	19-7-58	7.8	29.00	6.8	5.4
Jharoni	26-7-58	7.2	26.50	4.2	1.4
Nagda	11-7-58	7.6	30.00	—	—
Sonar-Talliya	23-7-58	8.1	26.00	—	—

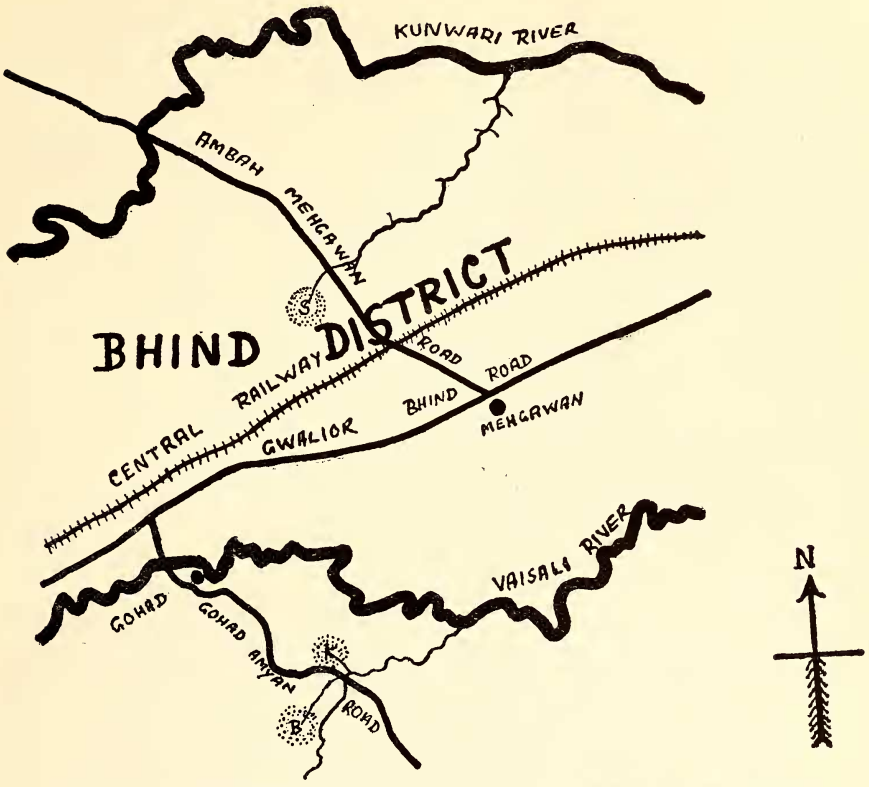
(ii) Sonarpura (S, Sketch-map No. 1). Brooders of *Labeo rohita* and *Cirrhina mrigala* have been observed to migrate from the Kunwari River of the Chambal system, through a nullah about 6 miles long, 4 ft. deep, and 4 ft. wide, to spawn in about 10 acres of inundated water around this village.

Fish-seed collection work in progress in Madya Pradesh

General view of inundated open field breeding ground



A Battery of Hatching Happas in Nagda wet-bund tank



Text Fig. 1. Bagthera, Khared, and Sonarpura Breeding Grounds
B. Baghthera breeding ground; K. Khared breeding ground; S. Sonarpura breeding ground

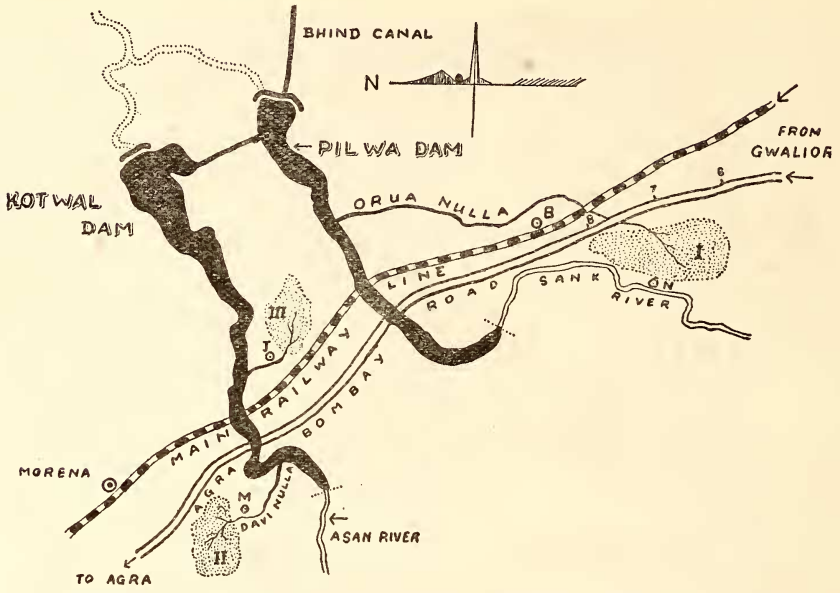
(iii) Khared (K, Sketch-map No. 1). From the Vaisli, a rivulet of the Chambal system, through a nullah about 6½ miles long, 10 ft. wide, and 6 ft. deep, brooders of Rohu, Catla, and Mrigal have been observed to spawn in an area of about 200 acres around this village. In the year 1958, as many as 8 lakhs of fry were collected from this area.

(iv) Sankalkheda. Spawning of *Labeo gonius* has been observed in the catchment area around a 12-mile-long nullah, 12 ft. wide and 8 ft. deep, which joins the River Betwa.

(v) Imalia-Jamalbagdi. *Labeo calbasu*, *Labeo gonius*, and *Cirrhina mrigala* have been observed to spawn in the inundated fields located in this village around a nullah 10 miles long, 6 ft. wide, and 4 ft. deep, which is connected with the River Betwa.

(*b*) Reservoir as a Home and Spawning in Inundated Fields

(i) Banmore spawning centre (Sketch-map No. 2). This is an important carp breeding centre and is located in the agricultural land (I) near Niraoli village (B) in Gwalior District. The nullah, known as Orua



Text Fig. 2. Banmore, Maharajpura, and Jharoni Breeding Grounds
N. Niraoli village; B. Banmore village; J. Jharoni village; M. Maharajpura village; I. Banmore breeding ground; II. Maharajpura breeding ground; III. Jharoni breeding ground.

nullah, connects the field with Pilwa reservoir which is bunded on the River Sank, a tributary of Chambal River. The monsoon in this part breaks by the end of June every year. The early showers are absorbed by dry soil. Subsequent rainfall of 3 to 4 inches covers the field with a maximum depth of about 2 inches of water. The Minnows and Catfish first negotiate the shallow current and migrate from the reservoir to the open fields. They spread out to the extreme boundaries and their breeding is restricted to this fringe with a depth of 6 inches to 1 ft. of water. As the monsoon advances, the water level in the nullah increases and *Labeo rohita*, *Labeo gonius*, and *Cirrhina mrigala* reach the breeding ground and occupy the area with a depth of water of 1½ ft. to 3 ft. or more. *Catla* being deep-bodied, reaches the breeding ground when the rainfall raises the depth of water in the nullah to about 4 ft. or more. Their breeding is confined to the area immediately in the vicinity of the nullah with a depth of 4 ft. and above. The nature of the water and the soil condition are given in Tables I and II respectively.

Fishes, having distributed themselves to the different regions as stated above, embark on sexual play and courtship. The males chase the females of their own kind and dart about in the water. This includes physical contacts of the male with the female and rubbing her body and knocking against and nudging her. At the climax of this activity the pairs are seen to be locked up in an embrace, their bodies are twisted

TABLE II

		Banmore Fields	Banmore Nullah	Nagda	Bilaoli	Butt
Clay	ppm. ..	24.80	20.10	9.10	40.15	57.08
Silt	,, ..	22.70	13.50	1.63	23.05	22.42
Sand	,, ..	75.50	67.10	87.70	32.17	14.06
Total salts	,, ..	00.179	00.063	00.151	00.423	00.219
Soil pH	,, ..	9.60	8.80	7.38	7.46	6.219

NOTE : The dominant soil constituents are underlined

round each other with the fins erect and the caudal fin quivering. It is in this posture that mating occurs with vigorous splashing of the water. The eggs are then laid and fertilised. The spent fishes flounder about and start their homeward journey along the receding water. Many are left behind, stranded amidst shallow pools and puddles, and ultimately get killed.

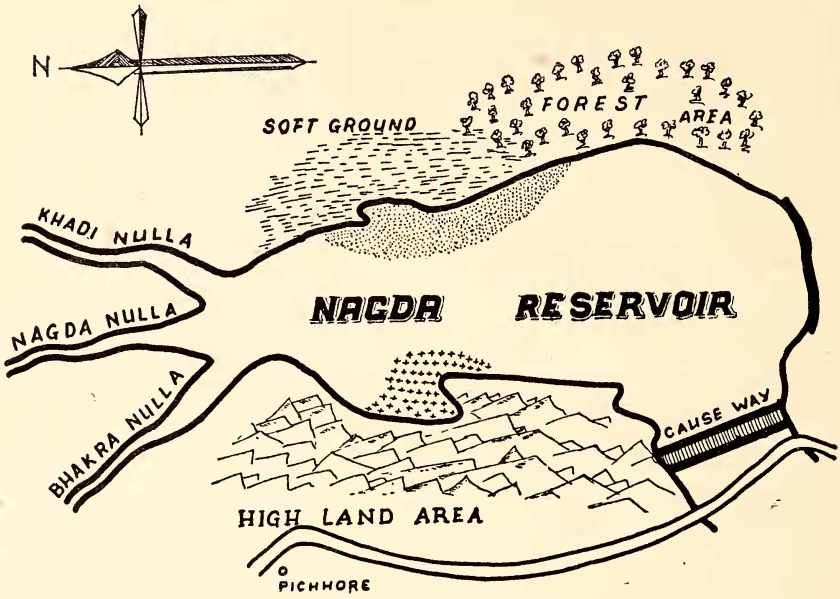
(ii) Maharajpura breeding ground (Sketch-map No. 2). This breeding site (II) was located in the fields of Maharajpura village (M). About 50 acres of the field form the catchment area around the nullah which flows into Kotwal Reservoir on the Asan Nadi, a tributary of the Chambal. The fields get inundated during the monsoon. Observations on the migration and spawning of the fishes are similar to those given under heading (i) immediately preceding.

(iii) Jharoni spawning centre (Sketch-map No. 2). The arable fields (III) of Jharoni village (J), measuring about 40,000 sq. yd., are connected by a nullah with Kotwal Reservoir. Since the discovery of this spawning ground in 1954, it has been a regular source of carp fry. In 1958, approximately 12 lakhs of fry were collected from this centre. The nature of the water at spawning time is given in Table I.

(*c*) Breeding in Reservoirs

(i) Nagda Reservoir (Sketch-map No. 3). This reservoir, measuring about 700 acres, is constructed on Budni Rivulet of Betwa River. It is essentially of the Midnapore wet-bund type. The eastern boundary is formed of hillocks and the western and southern sides are bunded. The waste-weir is located in the southern embankment. Three nullahs, Khadi, Nagda, and Bhakra, feed the reservoir. Carp spawning occurs in 50 acres of the marginal stretch within the F.T.L. (Full Tank Level) mark. The nature of the soil in this reservoir is given in Table II.

With the onset of the rains, the fresh rainwater mixes with the old standing water and spawning activities begin. The major carps spawn



Text Fig. 3. Nagda Reservoir

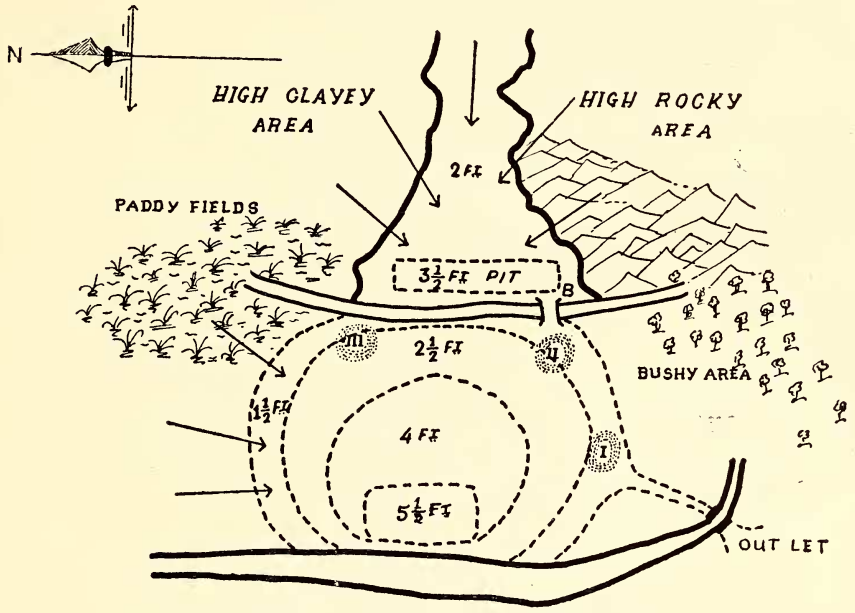
in one to four feet deep water. There is no current of water in the area of spawning, although there is a lot of wave-action. In 1958, as many as five lakhs of fry were collected. The nature of the water at the time of spawning is given in Table I.

(ii) Dinara and Mohari Reservoirs. Major carps were also found to breed in about 15 acres of marginal water in Dinara reservoir and in Mohari Reservoir, both constructed on tributaries of the rivers Sindh and Betwa respectively.

(iii) Bilaoli Reservoir. It is an old water-supply reservoir, 600 acres in area, situated about six miles from Indore. Its catchment area is four square miles. In 1954, the reservoir was completely dried up and stocked with the fish seed collected from Narmada River and the tributaries of the Chambal. In 1957, fry of major carps were observed in small puddles of water formed by the fall in the water level in the reservoir. During the 1958 monsoon, continuous watch was kept to observe breeding. On the 4th July, after it had rained for two days, brood fishes were noticed in the vicinity of the bund. Larger size brooders of Catla, Rohu, and Mrigal exhibited sexual play. The breeding took place along 400 yards of the stony embankment during bright sun in the forenoon. There was no flow of water as the supply of water from the tank was stopped during the monsoon.

(iv) Butt Tank. This tank is located in Chattarpur District. A nullah with an extensive catchment area has been bunded on its eastern

and northern sides by raising a Chandela-type bund[1]. The total area of the reservoir is about 20 acres. Breeding of carps in this reservoir has been observed since 1957. During 1958, as many as eight lakhs fry were collected. It was interesting to note that the major carps remained in the cool shade of *Trapa* and, after rain, they left the shelter and moved out for breeding. Soil analysis of this tank is given in Table II.



Text Fig. 4. SONAR TALLIYA DRY-BUND TANK

(*d*) Dry-Bund Breeding

Centre Sonar-Talliya (Sketch-map No. 4). As a result of the experience gained from the successful breeding of major carps in wet-bunds, an experiment in dry-bund breeding was conducted during 1958 at Sonar-Talliya, a shallow depression of 1.50 acres with an extensive catchment area. The topography of the area is hilly with arable lands towards the north. The southern side is rocky. An earthen bund was raised on the eastern side and was provided with a sluice-gate near its southern extremity. A supplementary bund was constructed on the western side. The northern and southern slopes were left open to allow the inflow of water. A more or less rectangular pit of 100 ft. × 50 ft. × 2 ft. was dug near the eastern bund for stocking the brooders. The average depth of the tank was 3[1] ft. Thus the total depth of the pit

[1] The bunds of reservoirs constructed during the regime of a former ruling dynasty, the Chandelas, were paved with stones fixed with mortar and were reinforced with earth. Bunds of this kind are referred to as Chandela-type bunds.

was 5½ ft. Brooders from a neighbouring tank were released into the tank and, as showers continued, more water flowed into the tank and water also started accumulating behind the western bund. The first group of brooders comprising 22 Rohu (size 15-18 in.) and six Calbasu (size 12-16 in.) was introduced on the 28th June. It rained heavily in the afternoon of the 10th July and the fish started their sexual play and at this stage a breach was made in the western bund allowing the accumulated water to flow in. They started to spawn by the evening (in the area marked I). Subsequently four Rohu (size 15-18 in.) were introduced on the 18th July and their spawning occurred in the night of the 23rd July with no fresh inflow of water (in the area marked II). After this, two Calbasu (size 13-14 in.) and six Rohu (size 16-17 in.) were introduced on the 2nd August and spawning took place during the night of the 14th August (in the area marked III). There was a slight rainfall on each day of breeding. The eggs were allowed to hatch in the tank itself and later on nearly four lakhs fry and fingerlings were collected. This dry-bund tank differs from the Midnapore type of dry bund in permitting no out-flow of water at the time of breeding.

Table I gives the chemical conditions of the water at different breeding centres. The water was alkaline (pH 7.2-8.2), with 4.2-6.8 ppm. of oxygen, and temperature between 26-33° C. The composition of that soil as given in Table II shows that breeding can take place over clayey as well as sandy bottoms.

3. Discussions

As the result of observations made at different spawning grounds, the following conditions pertaining to carp-spawning become apparent. They breed during the south-west monsoon from the end of June every year. Breeding takes place in various depths of water, from 6 inches to 6 feet depending on the size of the brooders. Spawning occurs over hard soil, sandy soil, and even over stony embankments. Breeding occurs in open fields, wet-bund tanks, and dry-bund tanks. Each time either a light shower, or heavy or continuous rains occurred prior to breeding. The oxygen content of the water at the spawning time is between 4.2 and 6.8 ppm., pH between 7.2 and 8.2, i.e. always alkaline, and the temperature ranges between 26° and 33° Centigrade. The fishes spawn in standing waters with wave action, and with regular flow as in the open fields.

Celestial bodies like the moon have no effect, as is evident from the Appendix. Carps have spawned twice on moonless days and so far no spawning at full-moon has been observed. There seems to be no correlation between spawning and the phases of the moon.

The effects of the endocrine glands particularly that of the pituitary and thyroid glands has been conclusively pointed out by Brown (1957)

who states : ' The pituitary gland is the first link between the receptor organs and the endocrine system. Environmental effects on other endocrine glands are probably mediated through the pituitary. Temperature might act directly on the gonads and the thyroid or the salinity of the environment might modify the ionic and osmotic content of the blood and thus stimulate the thyroid. However, the pituitary produces the tropic hormones and changes in the thyroid and gonads do not normally occur in the absence of pituitary. It seems safer to conclude that the external environment mediates its effect on the endocrine system through the pituitary.'

4. Conclusion

(i) Breeding takes place only after rains in various depths of water and varying currents of water-flow. It may even occur in standing water without any flow.

(ii) Soil may be hard and stony or soft and sandy.

(iii) Breeding takes place in bund type of tanks, rivers, or in open fields where rain water gets accumulated.

(iv) The pH of water may range between 7.2 to 8.2 during breeding and the temperature varies between 26° and 33° Centigrade.

(v) There does not appear to be any lunar periodicity effect in spawning as seen from the Appendix where the days of breeding and phases of the moon are indicated.

5. Acknowledgements

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